A Summary of Current Program 7/1/64;

and Preliminary Report of Progress

for 7/1/63 to 6/30/64

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STANDARDS AND RESEARCH DIVISION

of the

STATISTICAL REPORTING SERVICE

This progress report of U.S.D.A. and cooperative research is primarily a tool for use of scientists and administrators in program coordination, development, and evaluation; and for use of advisory committees in program review and development of recommendations for future research programs.

The summaries of progress on U.S.D.A. and cooperative research include some tentative results that have not been tested sufficiently to justify general release. Such findings, when adequately confirmed, will be released promptly through established channels. Because of this, the report is not intended for publication and should not be referred to in literature citations. Copies are distributed only to members of Department staff, advisory committee members, and others having special interest in the development of public agricultural research programs.

This report also includes a list of publications reporting results of U.S.D.A. and cooperative research issued between July 1, 1963, and June 30, 1964. Current agricultural research findings are also published in the U.S.D.A. publications, Agricultural Economics Research and Farm Index. This progress report was compiled in the Standards and Research Division, Statistical Reporting Service, United States Department of Agriculture, Washington, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE

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INTRODUCTION

There are three Divisions in the Statistical Reporting Service: Agricultural Estimates, Field Operations, and Standards and Research. The Agricultural Estimates Division is located in Washington, D. C. It administers crop and livestock estimating programs designed to provide current information about crop acreages and production, livestock numbers, and other statistics pertaining to the agricultural economy. The Field Operations Division has its headquarters in Washington, D. C., but it administers the field operational activities of the crop and livestock estimating and reporting programs through the medium of 43 field offices which serve the 50 States. The Standards and Research Division, also located in Washington, D. C., administers programs which include the research activities of SRS as well as statistical clearance. The research is conducted by the Special Surveys and the Research and Development Branches; both Branches perform service as well as research activities.

The Special Surveys Branch conducts research on the behavior, opinions, and preferences of consumers which affect their purchase and use of agricultural products or end products. These studies provide information of value in planning improved marketing of agricultural products, setting or revising grades and standards, and indicating areas requiring technical research to provide product qualities and characteristics which more closely satisfy consumer demand. The findings can be utilized to increase marketing and merchandizing efficiency all along the distribution line so that returns to producers can be improved and at the same time the satisfaction of consumers increased. The Special Surveys Branch also conducts research on reactions to agricultural programs and services which is designed to provide insights into measures which might be taken to increase their effectiveness.

The Research and Development Branch conducts research on sampling and survey methods as applied to the data collection activities of SRS, and development of techniques of statistical measurement equitable to substantive research.

The work of these Branches is being performed by a staff of about 17 professional employees. Part of the research is conducted by contract with private research organizations and cooperative agreements with land-grant colleges or producer and processor groups. On occasion, funds are transferred to the Division by other government agencies or farm organizations to finance special research studies undertaken at their request.

Some of the more noteworthy recent applications resulting from the research conducted by the Division are outlined below.

Results of studies conducted by the Special Surveys Branch on consumers' opinions of agriculturally-produced materials in various end uses have been used by natural fiber organizations to evaluate the position of cotton and wool in specific segments of the textile industry, and to encourage and guide private industry's efforts to improve the attributes of natural fibers so that they can compete more successfully with synthetics. In addition, each year the National Cotton Council of America bases a major portion of its promotion for consumers and retailers on these research results; these reports have also been used as standard examples in the market development program of Cotton Council International.

The preliminary results of a study of consumer acceptance of instant sweetpotato flakes, which were developed by the Southern Utilization Research and Development Division, indicated considerable commercial potential for the new product. Several firms are interested in or have begun production of this new convenience food.

The Special Surveys Branch has conducted a number of studies in cooperation with the Economic Research Service to evaluate the market potential for new or improved products developed by the USDA's Utilization Research Regional Laboratories. One of these projects indicated that a new superconcentrated apple juice, which was processed in such a way that the fruit juice aromas which would otherwise be lost were recovered, was well received by household consumers in a test market city. The report on that research created considerable interest. At least one large firm has undertaken commercial production of superconcentrated apple juice using an essence recovery process and the research department of an eastern university is experimenting with further developments in this product, stimulated by reports of the USDA work. The firm that originally cooperated with the Department in the first market test of the new juice subsequently undertook production of the juice with some variations from the Eastern Utilization Research and Development Division's original process. Preference tests in the Special Surveys Branch's sensory evaluation laboratory indicated that the variant product was much less acceptable to consumers than juice prepared by the original process. Market tests of the variant product were discontinued pending further technical research on product improvement.

The improved survey methods developed by the Research and Development Branch are being put into operation by SRS as rapidly as resources will permit. In December of 1963, full-scale enumerative surveys were conducted in 24 States. In June 1964, the enumerative survey program was expanded to include 32 States at an operating level, and pilot surveys in 16 States. Objective yield surveys for corn and cotton were also conducted--corn in 23 Southern and Central States, and cotton in 10 Southern States. The 1964 winter wheat survey included 15 States. The research program which produced the methodology for these surveys is coming into fruition through their incorporation into the operating program of SRS. Work is being continued both in survey methods and in objective yields.

AREA NO. 1: CONSUMER PREFERENCE AND QUALITY DISCRIMINATION-- HOUSEHOLD AND INDUSTRIAL

Problem. With the increasing complexity of marketing channels and methods, it has become almost impossible for consumers to express to producers either pleasure or displeasure with available merchandise. To market agricultural products more effectively, it is necessary to understand existing household, institutional, and industrial markets and the reasons behind consumers' decisions to purchase or not to purchase. Information is needed on consumers' attitudes toward old and new product forms of agricultural commodities, preferences, levels of information or misinformation, satisfactions or dislikes, and what product characteristics would better satisfy current consumers and/or attract new ones. It is also important to know the relationship between the consumption of one agricultural commodity and another in consumers' patterns of use, the relationship between agricultural and nonagricultural products, and probable trends in the consumption of farm products. Producer and industry groups as well as marketing agencies consider such information essential in planning programs to maintain and expand markets for agricultural commodities which, in turn, increases returns to growers.

USDA PROGRAM

The Special Surveys Branch conducts applied research among representative samples of industrial, institutional, or household consumers and potential consumers. Such research may be conducted to determine preferences, opinions, buying practices, and use habits with respect to various agricultural commodities; the role of competitive products; acceptance of new or improved products; and consumers' ability to discriminate among selected attributes of a product or levels of an attribute, and the preferences associated with discriminable forms.

In addition to the studies of consumer preference and discrimination, the Branch also provides consultants and conducts special studies, upon request, for other agencies in the USDA or within the Federal Government, when survey methods can be usefully applied to the evaluation of programs, services, or regulatory procedures of interest to the requesting agencies.

The research is carried out in cooperation with other USDA or federal agencies, State experiment stations, departments of agriculture, and land grant colleges, and agricultural producer, processor, and distributor groups. Closely supervised contracts with private research firms are used for nationwide surveys; studies in selected areas are usually conducted by the Washington staff with the assistance of locally recruited personnel.

The Branch maintains all of its research scientists, who are trained in social psychology or other social sciences, in Washington, D. C., which is headquarters for all the research whether it is conducted under contract or directly by the Branch. The Federal scientific effort devoted to research in this area during the past year totaled 7.0 professional man-years. An additional .2 professional man-year was devoted to research conducted under a transfer of funds arrangement.

A. Consumer Preference

1. Fibers in wearing apparel. The rapid expansion in recent years in the use of man-made fibers and blends necessitates up-to-date evaluations of consumer reactions to natural fibers in specified end uses. Such data give industry a better understanding of its markets, and provide a guide for planning physical science research on product improvement as well as educational, promotional, and merchandising efforts designed to strengthen the market position of cotton and wool.

A contract has been signed with a market research firm for a nationwide survey among women to provide current information on their experiences, beliefs, attitudes, and complaints related to natural and competing fibers in selected items of clothing. The Department and the cotton and wool industries, in an effort to meet the increasing competition from manmade fibers, have developed new forms of materials in recent years (for example: improved wash-and-wear, wrinkle resistant, permanently creased, and stretch cotton; and machine-washable and permanently creased wool); consumer reactions to these new developments will also be assessed.

A preliminary report on the results of a contract study of reactions to fibers in clothing among a nationwide sample of teenage boys and girls will be issued during the Fall of 1964; a final report presenting more detailed findings is in preparation.

The preliminary results indicate that wool was the leader in ownership and preference for winter skirts, boys' sport coats, and boys' and girls' sweaters and outer short coats. Warmth was the main attraction of wool, although its ability to withstand wrinkles, to hold its shape, and its soil resistance were also frequently mentioned as reasons for preferring it over other fibers. Cotton was the leader in summer clothes for both boys and girls. It was the winter favorite as well among boys for everyday pants and sport shirts and among girls for everyday dresses and blouses. Comfort was the main attraction of cotton, winter or summer; that is, it did not irritate the skin, it was cool in the summer, and warm enough or not too warm in the winter. In addition, girls stressed the ease of washing and ironing cotton as a reason for preferring it over other fibers.

Cotton-polyester was important in summer wear for girls and boys. The teenagers who preferred it gave, for the most part, the same reasons for their preference as those who chose cotton. However, cotton-polyester had the added attraction that it did not wrinkle. Nylon was the most frequently owned and preferred fiber for girls' slips and half-slips, mainly because of the ease in care and laundering. Acrylic fibers were important, after wool, either alone or in blends, in winter sweaters. Those who preferred acrylic in sweaters did so because it did not irritate the skin, held its shape, and, of especial importance to girls, could be easily washed.

2. Poultry. A nationwide survey is being conducted under contract by a private market research firm to ascertain household consumers' preferences, use patterns, and purchasing practices for broilers and turkeys. Questionnaire development and pretesting have been completed; interviewing is scheduled for the summer of 1964.

The study is similar in some respects to the 1956 USDA study on poultry, and some questions have been repeated from the earlier study to provide information on trends in usage since that date. However, the questionnaire was revised extensively to obtain information on current problems and to reflect the many changes which have occurred in the poultry industry in the past six or seven years. Data from this study will provide insights into the measures which might be taken by the poultry industry to market their products more effectively and to increase demand among household consumers.

3. Milk. A final report is in preparation on a study to ascertain household consumption patterns for fluid milk and to provide insights into the reasons for consumers' use of selected fluid milk products. This survey is part of a research project conducted in cooperation with the ERS. Since major interest focused on the market potential for low-fat fluid milk of approximately two percent butterfat content, interviewing was conducted in two cities in which low-fat fluid milk was available. Information was obtained on such topics as consumers' attitudes toward various types of milk, milk consumption habits during the preceding five years, changes in those habits, and the reasons for the changes.

4. Noncitrus fruit. Interviewing and coding have been completed on a nationwide contract survey among homemakers to ascertain the frequency and patterns of use for selected noncitrus fruits, as well as the attitudes and opinions which influence their use or nonuse. Specific topics investigated included the kinds of fruits purchased, reasons for purchase or nonpurchase of specified fruits, qualities associated with particular fruits, and buying patterns. Additional data were collected on apples, the retail volume leader of fresh noncitrus fruit.

5. Sweetpotatoes. The complete report of results of a panel test to determine household consumer acceptance of a new dehydrated instant sweetpotato flakes, developed by the Southern Utilization Research and Development Division of the Agricultural Research Service, has been published. The test product won the approval of a panel of homemakers in the Washington, D. C. area; the findings have been discussed in detail in a previous progress report.

6. Duration of household food supplies. A final report has been published on a nationwide survey to obtain homemakers' estimates of how long their food stocks on hand could be made to last if an emergency should cut them off from outside food supplies. This study was conducted at the request of, and financed by, the Office of Civil Defense and Defense Mobilization of the Department of Defense. When asked how long they could stretch present food supplies with all the family members at home all the time, but feeding them only enough to get by on, nearly a third of the nations' homemakers said they would run out of food within a week or less. About the same number said they could stretch their food supplies to last more than a week, but not more than two weeks. Overall, 86 percent of the homemakers thought they would run out of food on hand within a month or less, while 12 percent said they could make their food last longer than a month. Homemakers in congested areas generally expected more rapid food depletion than those in less populous parts of the country. Higher income groups tended to estimate their food stocks would last a greater length of time than was true of lower income groups. The northeastern section of the country reported the fastest rate of expected food depletion, followed by the southeastern section; the least rapid rate was reported by the northwestern area.

7. Consultation. The Branch has provided consultants for a number of studies conducted by other agencies. One such project involved research on West German consumers' reactions to selected citrus products. The study was designed to aid Florida citrus processors in determining the most desirable sugar-acid levels in packs of canned single-strength citrus juice for export, and in understanding the attitudes of European consumers toward the use of citrus products.

A representative of the Branch served on a research team to help evaluate the effectiveness of the U. S. Food and Agriculture Exhibition in Amsterdam, The Netherlands. The exhibition was part of the Department's effort to expand overseas markets for U. S. farm products.

B. Quality Discrimination

To accommodate a greater proportion of the requests received for small group experiments in taste and visual discrimination and provide facilities for investigating a broader range of sensory evaluation problems, a laboratory tailored to such psychophysical research was installed during the past year. The laboratory is used to ascertain, under controlled conditions, people's ability to discriminate among qualities or levels of a quality for food samples, or other sensory or visual stimuli, and the preferences associated with discriminable variables. The products which have been evaluated include new food forms developed in the ARS laboratories or variations of products already available. Studies have been conducted on apple juice concentrate, grape juice concentrate, powdered grapefruit juice, fresh orange juice, dried milk, canned peas, and dehydrated potatoes. Some examples of the types of problems investigated in the past year are listed below. The results of these experiments have not been published, but were reported by memorandum to the cooperating groups requesting the research.

Peas. Two types of canned peas were rated on a preference scale. The experimental peas were treated with 470 ppm methionine, the control peas were standard pack. No significant difference was noted in the mean preference ratings for the two samples.

Grape juice concentrate. An experimental grape juice concentrate was reconstituted in two ways: as a juice with 2 parts of water to 1 of concentrate, and as a drink with 6 parts of water to 1 of concentrate. These experimental products were compared with a grape drink and a grape ade currently on the market. Thirty-six subjects tasted and rated each of the four products, identified to them simply as "grape juice." There were no significant differences between the mean preferences for the commercial drink. The grape drinks were significantly preferred to the test product as a juice and to the commercial ade, however.

In a second test, the problem was to determine what ratio of water to the experimental concentrate was preferred. The concentrate was reconstituted at five levels, using 4, 5, 6, 7, and 8 parts of water to 1 of concentrate. Subjects tasted and rated their preferences for each of the five products. Mean preference scores for the concentrate mixed with 4, 5, and 6 parts of water did not differ but were significantly higher than those for the concentrate mixed with 7 or 8 parts of water. The results indicate that a reconstitution at 6 parts of water to 1 of concentrate would be acceptable.

In addition, a series of studies was conducted to determine the effects of length of storage at various temperature levels on preferences for this product. Samples were stored at three temperatures (40, 70, and 100 degrees F.) and were evaluated at regular intervals during the following eight months. After eight months, the preference ratings for the samples stored at 70 degrees did not differ significantly from those for the samples stored at 40 degrees, indicating that the product did not require valuable freezer space. However, after approximately six weeks, the samples stored at 100 degrees showed a significant deterioration in flavor as evidenced by preference scores.

Consumer Preference

Hollon, D. S. 1964. Household Consumers' Acceptance of Instant Sweetpotato Flakes. Marketing Research Report No. 663

Homemakers' Estimates of How Long Food on Hand Could be Made to Last, 1964. Marketing Research Report No. 669

AREA NO. 2: IMPROVEMENT OF CROP AND LIVESTOCK ESTIMATING PROCEDURES

Problem. The Statistical Reporting Service produces a large number of current statistics pertaining to agriculture. Because of limited resources, statistical methods were devised with a view to producing the most information for the least cost. These methods are subjective in nature and are based largely upon self-selected samples from voluntary crop reporters who fill out and return mailed questionnaires. The information is generally collected in the form of relatives such as acres this year compared to last, and crop condition as a percentage of full crop. Persistent bias is removed by charting, and census or other check data are generally projected to form current estimates. Estimates based on these sample methods have proved relatively satisfactory over the years. However, in seasons when changes are unusually large, the changes may not be fully reflected in the appraisals and reports of the respondents to mailed questionnaires. In situations like this, when accuracy is needed most, the estimates may lack the required precision. Then, when the estimates are translated into available supplies for the different commodities, price inequities may occur and, as a result, producers or the processors of agricultural commodities may suffer serious financial loss.

With the development of modern statistics, new methods based upon probability sampling have been developed. Although surveys based upon probability sampling are more expensive to conduct than the tranditional self-selecting mailed survey, these new methods offer a means of increasing the precision and reliability of the estimates. Because of the need by the agricultural economy for high quality statistics, it is mandatory that the statistical theory and methods be developed and adapted to the collection of agricultural statistics. Some of the new procedures have already been introduced but there is an urgent need for a continuing research to devise efficient survey methods so as to make possible continuing improvement in the quality of SRS statistics.

USDA PROGRAM

The Department of Agriculture conducts a program of applied research designed to strengthen and improve the methodology used in collecting agricultural statistics. The principal disciplines involved are mathematics, statistics and probability, but other disciplines relating to a particular problem are brought to bear as required. Examples of these are plant physiology, psychology, cartography and photogrammetry. The current program consists of 6.0 professional man-years per year devoted to the study of sample and survey methods, and 4.0 professional man-years working on methods for forecasting and estimating the yields of important crops. Work under this program is done in Washington, D. C., and in SRS field offices located in the States concerned.

Research objectives in survey methods are concerned with the improvement of all aspects of survey design. These include questionnaire and form design, universe definition and sampling frame construction, sample design and estimators, enumeration techniques, quality checks, editing procedures, methods of processing data and the post-analysis of the survey with a view to improvement of design. In the current program priority is being given to completing the construction of an area sampling frame for 11 Eastern States; to the investigation of sources of lists, their maintenance and optimum use as sampling frames for probability sampling; and to the problem of developing methodology for collecting data by mail and enumeration in the same sample survey using lists in conjunction with area as frames. A preliminary exploration of the possibility of using aerial photography in estimating acreages of crops and numbers of livestock is being made. In this area, problems requiring study are those of sample design and photo-interpretation as well as the use of this technique to supplement a general-purpose survey. Response errors are being studied. Here the objective is to

establish communication with the respondent through the medium of a questionnaire which will transmit concepts with a high degree of fidelity and at the same time induce the respondent to reply, and reply honestly and fully. An attempt is being made to distinguish between those items for which the respondent has accurate knowledge, those items which he may have once known but no longer recalls accurately, those items which he had never known precisely, and those items for which he is unwilling to divulge information or gives deliberately misleading information. Where applicable, alternative sources of information will be sought and different ways of motivating respondent cooperation will be tested.

Work on objective yields is being continued. This includes the refinement of the forecasting models being tested as well as the development of forecasting procedures for other important crops. Corn, cotton, wheat, and soybean models are being refined by computing parameters based upon larger samples and by broadening the range of plant maturity recognized by the model. Among the other crops for which objective forecasting procedures are being developed are grapes, onions, sorghum, and pasture grasses. The studies on forecasting sorghum yields and the production of pasture grasses are being conducted under a cooperative agreement with Iowa State University in Ames, Iowa.

REPORT OF PROGRESS FOR USDA AND COOPERATIVE PROGRAMS

A. Objective Measurement of Yields

1. Wheat. Except for a reduction in the number of fields used for post-harvest observations, the 1964 sample size in the nine operational States was about the same as in 1963; however, some reallocation of fields between States was made for the 1964 surveys. The reduction in post-harvest observations plus some decrease in the number of fields used for weekly development work allowed an increase in the early season counts in the pilot wheat States. The 1964 sample included about 1,300 fields in the nine operational States, 280 winter wheat fields, and 420 durum and other spring wheat fields in the pilot States.

During the 1963-64 crop year a considerable portion of available resources was consumed by necessary expansions in the computer forecasting program. During the latter part of the season the States for the first time were relieved of all listing, summarization, computation forms and acreage record forms which related to the wheat objective yield. The new wheat forecasting program which is programmed for the 7074 computer now assumes these relatively menial duties. Considerable hand calculating was required to supplement output from the computer program since it was not fully operational until September. The lack of a parallel analysis program was also responsible for both a large amount of hand calculating and also for the inability to utilize the full potential of the forecast program. The tentative plans are to have an analysis program operational by May of 1965 so at this time we should be able to utilize the most current concepts of "best forecasting models." Since this concept of "best forecasting models" should not be allowed to become static, the program is flexible enough so past performance of a forecast model and also new possibilities arising from the weekly development observations can be utilized.

The pilot States had a total of 42 weekly development samples in 1964. Since two years of development data are now available, consistency of growth curves between years will be a major point to be observed. This year's weekly development forms were also designed to provide data which can be used to determine the optimum size and shape, considering both variances and costs, of a sample wheat unit. The size and shape of frame now being used was inferred from earlier studies pertaining to wheat. Gathering of data for this purpose was patterned after methodology used in the

"1960 Sorghum Production Study" done jointly by SRS and Iowa State University. Along these same lines of optimization, detailed data were obtained on between and within segment time and mileage costs. Although these data have not as yet been utilized in sample optimization, there is evidence the forms have increased sampling efficiencies by causing enumerators to become more cost conscious.

2. Sour cherries. Due to a reduction in budget the surveys for the three pilot States (New York, Pennsylvania, and Wisconsin) were not conducted during 1963 and the survey in Michigan was reduced to 90 sample orchards. This reduction in sample size in Michigan contributed to an increase in the coefficient of variation for the pre-harvest survey to about 30 percent for weight of fruit per tree instead of the 12 percent for previous years. This sampling error is due almost entirely to variation in fruit count per tree.

Weekly development observations were made on two trees in each of six Michigan orchards, two orchards in each district. Twelve samples of 20 cherries each were used for observing growth and drop patterns between bloom date and maturity. Visits were made biweekly with emphasis on obtaining more carefully controlled and recorded data on the pit hardening cycle. The major point of reference for fruit maturity has been bloom date. It is hoped that more current maturity reference points will be provided by the pit hardness index. Improvement in ability to place a sample in its proper stage of maturity is essential when slope of drop and development curves varies so much as the maturity of the fruit progresses.

With the conclusion of the 1963 surveys, research is fairly complete for most phases of this study. Except for some continued small scale development work and a more complete sampling frame, the program for forecasting of cherries in Michigan and possibly New York, Pennsylvania, and Wisconsin is ready for extension to an operational level. For Michigan, it is suggested that about 900 sample orchards would be required to reduce error to 5 percent at the 68 percent confidence level for the preharvest survey. The old sample frame of 100 areas is not adequate for the recommended operational level. Updating of the area frame or an area frame supplemented by producer lists should be investigated. If only a list frame is used this should be nearly complete and any incompleteness should not be confined to certain classes of orchards or trees.

3. Soybeans. The objective yield study on soybeans was conducted in nine North Central States, Arkansas, and Mississippi in 440 sample fields during 1963. Field procedures were changed from 1962 to include counts of nodes on the main stem with fruit and lateral branches with fruit. These additional counts were made to help reduce the over-expansion of pods with beans that are predicted for harvest. Using these counts instead of the average pods per plant for estimating the number of pods with beans reduced the over-expansion by 8 percent.

In the past the August 1 yield forecast has not provided reliable indications by States. One weakness has been a lack of detailed early season fruiting information. In 1963, weekly counts and observations were made in 10 fields during the growing season in Mississippi and Kansas to obtain additional information for improving the early season forecasting models. From analyses of these counts, more maturity categories for predicting the maximum pod load are being developed for the August 1 model.

For the September 1 forecast, a model was developed to forecast the ratio of estimated pods with beans present to pods with beans at harvest using planting date as a dependent variable to adjust for stage of maturity. Results showed that planting date alone is not sufficient to determine or adjust for maturity stage. More sensitive variables are being sought to help refine this model.

For 1964 detailed counts will be made on plants with a six-inch row section beyond each row instead of the first two plants. This change will about double the number of plants for observations but will help reduce the variation between plants and the positive selection of plants by the enumerator. A single preharvest visit is scheduled for about 740 fields in 11 States for making an estimate of yield at harvest time.

To study the fruiting patterns in other areas, weekly counts are being made in 20 fields in Minnesota, Iowa, Ohio, and Mississippi during the 1964 growing season. Revisiting fields in Mississippi should indicate any changes in fruiting patterns from 1963.

4. Irrigated cotton. This study was continued in 190 sample fields during 1963 to test previous results and to obtain data for refining forecasting parameters. Procedures were generally unchanged from those used in 1962. Results of this study indicate that the general forecasting models employed are adequate and that variability of early season forecasts can be controlled by:

(1) Further refinement in the forecasting parameters employed in the models.

(2) Increasing the number of sample fields used for making forecasts.

(3) In California, developing two different sets of forecasting parameters; one for the Imperial Valley production area and another set for the remainder of the cotton producing areas within the State.

5. Onions. Development studies were conducted in Michigan in 1962 and 1963 as a preliminary step in determining the feasibility of objective forecasting of onion yields for the late summer onion crop. A tentative goal would be accurate yield forecasts as of August 1 or later. During 1963 the study was aimed primarily at determining a growth pattern and well-defined bulb development stages that could be used in forecasting final onion weight. In 1962 and 1963 it was determined that the number of plants per unit of area can be estimated by using the row density and distance between rows.

Weekly observations were made from the time of the beginning of bulb formation until harvest. During 1962, two major varieties with different planting dates were observed. Three weekly samples were taken from one planting and two from the other. In 1963, two samples were taken from each of three varieties planted at the same time and two samples taken from each planting of one variety planted at different times.

Evaluation of the development of the bulb through the growing season indicates that both size and weight increase fairly steadily until about 120 days after planting and thereafter at a decreasing rate until harvest.

Time of planting, days after planting, weather, and to some extent cultural practices effect the development of the bulb. Analysis of the data through 1963 indicated that additional data were needed to give stability to the bulb development curve. Also, additional investigation will be necessary to determine, if possible, definite stages of bulb development. One major difficulty in making observations on bulb development is that the plant must be pulled since the above ground portion of the plant does not give adequate information on bulb formation.

The 1964 program is being designed to extend the existing series of data. Location, varieties, and relative planting dates will be the same as 1963. Additional data will also be collected on dry matter determination and bud formation within the bulb.

6. Grapes. Development studies were conducted in Michigan from 1960 through 1963. The purpose of the study was to determine the feasibility of objective forecasts of grape production.

A continuing series of data has been collected. The project was conducted on three representative vineyards. Visits were made to the vineyards twice monthly from July until September harvest. At the first visit, three rows were systematically selected and within each row one vine was selected at random. These vines were referred to as "count" vines. On these vines bunches were counted and every fifth bunch was marked. On the marked bunches all berries were counted. Also, at this time an adjacent vine (same row) was selected and a count of bunches made. These vines were referred to as "clip" vines because after the bunches were counted every fifth bunch was removed for laboratory determinations. Weight per bunch and number of berries per bunch was recorded. On subsequent biweekly visits the bunches were again counted on "count" vines to derive missing bunches. Also, another "clip" vine was selected and data were collected as outlined above under the "first" visit. Marked bunches on the "count" vine were clipped on the last visit and "clip" vine determinations were made on the bunches. In addition to the continuing series of data, a special 1962 preharvest study was conducted on 25 orchards. The purpose of this study was to provide more precise estimates of reliability and forecast relationships.

Analysis of data indicated that droppage of bunches from July 1 to harvest was insignificant. An analysis of variation of "clip" vine bunch counts (considering bunch counts as though they were made at the same point in time in a season) suggests that vines within rows are not related because of their proximity to one another. Therefore, it appears that adjacent vines can be sampled as efficiently as vines spaced further apart in the row. Variation between vines over years was large as compared with variation between rows within the same vineyard and between vineyards. For the 1962 preharvest survey, an analysis of variation of bunches per vine indicated that when cost of data collection between vineyards was high as compared with costs between rows, a sample of two or more rows per vineyard and about two or three vines per row should be sampled. Another analysis of variation from the laboratory determinations of berries per bunch suggested that the optimum number of vines per vineyard would be about seven.

As mentioned above, July counts of bunches per vine may almost be used directly to forecast final bunches. Also, a July regression estimator of berries per bunch gives a good forecast of final berries per bunch. Bunch weights vary but it is expected that the number of berries per bunch contributes more to the variance of bunch weight than does berry weight. Results of this study indicate that accurate forecasts of yield are possible; however, larger samples are needed to refine forecasting parameters and test hypotheses that have been made.

7. Pasture. A pasture production study has been conducted since 1961 under a cooperative agreement with Iowa State University. The study was designed to investigate a means of measuring the amount of forage produced and the amount of grazing off by livestock.

The study during 1963 was conducted on four University-owned pastures. Two procedures were used both using a 3' x 3' x 18" "cage" that was designed to prevent grazing beneath it. Under Procedure I cages were moved periodically. Ten cages per field were randomly located and set during the initial visit then systematically moved each period. The cages and periods were: three cages moved every week; three cages moved every two weeks; and four cages moved every four weeks. Each time the cages were set, two 3' x 3' plots were clipped by hand as close to the ground as possible immediately outside the cage. At the end of each period the area under the cage was clipped and the plots were again harvested. Gross production and grazing during the period were

derived. Procedure II utilized stationary cage locations. An average of four cages per field was used with the area beneath them harvested every two weeks throughout the season. Only production was derived using this procedure. Plot clippings were dried to a uniform moisture and weighed for both procedures.

Only growth data were analyzed because of different numbers and types of livestock. An analysis of variance for Procedure I based upon the total season's growth per plot showed no significant differences at the five-percent level among pastures or among types of cages. It was noted that the forecasted seasonal production for the two and four week cages for all pastures was nearly equal. A separate analysis of variance for each caged period (one week, two weeks, and four weeks) also showed no significant difference at the five-percent level among pastures. The coefficient of variation for one week cages was twice that of the other two caged periods. This plus the fact that the forecasted seasonal production for all three caged periods did not differ significantly would indicate that it was unnecessary to count plots as often as every week. The analysis of variance of Procedure II data showed a significant difference among pastures at the one-percent level. Interaction between time period and pasture was also significant at the one-percent level. Procedure II eliminated the possibility of negative plot production. Variation among cages within pastures was considerably smaller for Procedure II. Production for the entire season was generally below that of Procedure I.

The 1963 results brighten somewhat the prospect of being able to effectively estimate pasture production. Expanded plot productions for the season were generally reasonable. It is difficult to generalize whether such a plan as is being studied could be adopted over such a large area as a State. Coefficients of variation do indicate that sampling error could be controlled without a prohibitive sampling rate. At present, there is no evidence that periodic clipping has any effect on growth either to reduce or increase. This would seem to eliminate the need for weekly clipping in 1964. In other respects the 1964 study will be the same as 1963.

8. Sorghum. The 1963 work by Iowa State University makes the fifth year in which grain sorghum has been studied in an attempt to establish procedures feasible for operational use in forecasting and estimating grain sorghum production.

Work in 1963 was primarily aimed at gaining additional experience with procedures investigated previously rather than new investigations. Also, a post-harvest gleaning study was conducted. The number of farms was about the same and, where possible, were the identical farms as in 1962. Some changes were made in field procedure and data collection based upon the 1962 results. Main changes were made in row length (reduced from 18' to 15') and row subdivision based on analysis of plot size study. Separation of main stalk and tiller counts and measurement of height of plant were discontinued because of the small incident of tillers.

The estimation technique used thus far to obtain plot yield has been to estimate number of heads and multiply by the average weight per head. Prediction of the number of heads to be harvested by a regression method seems quite satisfactory. The difficulty comes in predicting weight per head.

The relationships between August and September plant characteristics and average dry kernel weight per head at harvest were examined. All data were reduced to a per head or a per foot average for each farm. Simple regressions were compared for each of the variables with head weight at harvest. On August 1 the two variables with the highest coefficients of determinations (R^2) were number of plants per foot and the average dry weight per head, respectively. For September 1, the number of heads per foot had the highest R^2 value. The multiple regression to forecast mature head weight on August 1

was based on: plants per foot, dry kernel weight, August indicator, percent dry matter, and percent heads, and gave a multiple R^2 of .71 as compared with .66 in 1962, and .50 in 1961. However, the predicted dry kernel weight per head from the multiple regression was 17 percent greater than the weight at harvest.

One of the difficulties in the procedures used is that the dependent variables are not without error. Therefore, a grouping was tried based upon dry kernel weight per head. All plot data from farms with less than 30 percent heads on August 1 were removed from the analysis. The remaining plot data were divided into two approximately equal size groups using dry kernel weight per head. Then the growth of dry kernel weight as a function of percent dry matter was studied. By using a transformation the data could be represented as a set of parallel lines. To do this it was necessary to combine percent dry matter through a covariance type of analysis with percent heads. The graphic representation was obtained by taking the fourth root of dry kernel weight as the dependent variable and a graphic transformation of the combined percent dry matter and percent heads data as the independent variable. This analysis shows a consistent relationship for the years considered, 1961-1963. However, it will be necessary to verify whether this relationship will hold for independent data collected over years and locations.

B. Survey Methods

1. Response Errors. In the December 1962 Enumerative Survey an open-closed expansion was used for livestock in an attempt to derive some benefits of both the open segment and closed segment approach to area sampling. Briefly, this open-closed segment expansion consists of adjusting livestock on the entire farm by the proportion of land in the farm which falls inside the segment. In some cases, the difference between the closed and the open-closed expansions was much larger than can be explained by sampling error.

Two States (Iowa and Alabama) were selected for follow-up study of the December 1963 Survey to investigate expansion differences and other problems of enumeration. Immediately following the survey a sample of tracts was selected. The operators of these tracts were re-interviewed using a questionnaire designed for collecting data by parcels of land. A parcel of land was defined as "land not bounded by other land in the farm, under one tenure arrangement, and not divided by the segment boundary." The data collected consisted of selected items from the December Survey and information necessary for time lag adjustments. Strong probing techniques were employed by enumerators in collecting the data.

For analysis purposes the operators were divided into three categories:

(1) Operators with all their land inside the segment.

(2) Operators living in the segment but farming land both inside and outside the segment.

(3) Operators living outside the segment and farming land both inside and outside the segment.

Differences from the December Survey were found in all categories but were smaller and less frequent in Category 1. For livestock and poultry inventories (cattle, hogs, and hens and pullets) a difference occurred for each specie in about 20 percent of the cases in Iowa. In Alabama, differences were less frequent for hogs but more frequent for both cattle and hens and pullets. The average difference per tract was relatively small but, when expanded, the estimate and its variance were seriously effected is some instances.

The most frequent problem was that of response variation due to an estimate being given in both cases and without agreement. Other common problems were:

(1) Change in reported location
(2) Additional operations located in tract
(3) Non-owned animals omitted
(4) Difference in respondent

Differences in the breakdown of animals by classes within specie appear to occur mainly because of a lack of clear understanding between interviewer and respondent.

2. List Frames. This project was initiated in 1962 with the matching of names from the 1961 State Farm Census and the 1961 June Enumerative Survey. After the names were matched comparisons were made for several items from the two surveys. Smaller operators tend to report much larger acreage operated on the June Survey than on the State Farm Census while very large operators report larger acreages on the State Farm Census. The same pattern was obvious for matched crop and livestock items. Apparently these operators are reporting consistently, i.e., crops and livestock are reported for whatever acreage is reported as being operated. These differences appear relatively stable by geographic area, type of interview, and over years.

On the June 1963 Enumerative Survey the acreage operated was classified as to tenure arrangement. These names were matched with the 1963 State Farm Census to investigate the effect of tenure on reporting. For this match, operators were divided into four mutually exclusive groups:

I Land owners who do not rent to or from others.

II Land owners who rent additional land but do not rent to others.

III Tenants who do not own land and do not rent to others.

IV Land owners who rent to others (may also rent land from others.)

The most consistent pattern appears in Group II where the difference in reported acres exactly corresponds to either owned or rented acres in about half of the cases.

In all groups there is evidence of a strong relationship between acreage either inside or outside the segment and the difference in reported acreage from the two surveys. Since the segment used in the June Survey has no meaning in the State Farm Census this relationship must be a result of the physical divisions used for segment boundaries and indicates that operators tend to omit land in the State Farm Census when it is physically separated from other land.

3. Probability Mailing List. Analysis of the data collected in 1961 under this project has not been completed. A computer program for deriving an "Interest Index" for each of the farm operators included in the list was completed during 1963. This program was used to derive a number of different Indexes based on different functions of the individual farm characteristics which were obtained during the screening process when the list was originally established. Basically, the "Interest Index" is based on the premise that "relatively large" farm operators are more likely to return a questionnaire by mail than small farm operators. A farm is determined to be "large" or "small" based on the relative magnitude of the different farm characteristics, either individually or in combination depending on the type of Index being derived.

Two types of Indexes were developed: (1) a general Interest Index, and (2) specialized Interest Indexes. The general Index was derived using a composite function containing all known farm characteristics, while a number of different specialized Indexes were derived based on the relative size of one or possibly a combination of two characteristics. The specialized Index looks most promising, especially for determining relationships which will enable adjustments for non-response bias in estimates based on mailed returns, or will reduce the number of non-respondent interviews. Further refinement in the Indexes already developed are needed in order to establish and define the different relationships and allow the formulation of hypotheses. The degree and direction of the necessary refinement will depend upon the estimates of non-response bias which remain to be made from the 1961 data. Other relationships will be examined in the attempt to develop practical and inexpensive estimating procedures for use in improving the current crop and livestock estimating program.

4. Aerial Photography as a Supplementary Technique in Making Crop and Livestock Estimates. In 1963 a study was conducted to explore the possibility of developing interpretation keys for identifying different kinds of crops and livestock from aerial photographs; of measuring acreage and counting the number of livestock from the photographs; and to explore ways of incorporating aerial photography into a sample survey. This study was under a cooperative agreement with the Vidya Division of Itek Corporation.

The aerial photography was obtained with Itek's Hyca panoramic camera. Trial flights for determination of photographic specifications were made in California then operation flights were made over areas in Utah, Wyoming, and Colorado at altitudes ranging from 5,000 to 14,000 feet above ground. The total area coverage of the photography was nearly 700 square miles. Most of the photography was flown between 8:00 and 10:00 a.m. to take advantage of clear atmosphere, optimum light angle for interpretable shadows and visibility of animals in the open during the cool of the day. On the same days that the photography was flown, enumerators went into the field to count livestock and identify crops in selected ground areas.

The result of livestock surveys at a scale of 1:5,000 to 1:6,000 feet were successful for detection and identification of animals by type, age class, and, in many cases, breed. The study indicated that a minimum scale for livestock survey is between 1:7,000 to 1:8,000 feet. Accurate counts of livestock on photography were difficult in many areas where the tone of the background approximated that of the animals and where livestock was obscured by dense ground cover. The comparisons of livestock counts between the photo-interpretation and the ground sampling were fair with a lower count obtained from the photography.

The study indicated that aerial photographic livestock surveys are feasible once reliable livestock keys are developed. These keys can be developed providing: (1) that a camera-film-filter combination is used which will yield extremely high ground resolution, (2) that ground cover is not so dense as to obscure livestock, and (3) providing experimental photography be restricted to an area small enough to permit enumerators to identify individual animals and record the identification in detail at time of the flight.

In earlier stages of growth, grain crops were easily distinguished from row crops. The study indicated more research is necessary to determine the smallest photo scales at which plants of different types or the fields in which they are grown can be accurately identified and that reliable keys could be developed once the crop begins to mature. Additional development work involving ground and aerial spectral reconnaissance to optimize film-filter selection is needed for more accurate crop identification.

5. Sampling Procedures in the Eastern States. The construction of a new area sampling frame was initiated in 13 Eastern States (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, West Virginia, and Florida.) The rapid expansion of urban areas during recent years and continued changes in land use in these States has created an acute need for a more up-to-date frame to efficiently and effectively collect sample data for a variety of crop, livestock, and farm economic items. The principal objective in the frame construction was to classify the entire land area for these States according to its current use. The primary land use strata were intensively farmed land, extensively farmed land, land devoted to urban use, and non-agricultural land (open land that supported no agriculture.) This sampling frame was completed for the three major agricultural States in the above group (New York, Pennsylvania, and Florida) and used as a basis for allocating sampling units for the June 1964 Enumerative Survey. A large portion of the work for the remaining States has been completed for all remaining States. Results from the pilot 1964 June Enumerative Survey in the three States for which the frame was completed show substantial efficiencies in sampling errors and data collection. These efficiencies are attributed to improved stratification and control of segment size as well as number of farms per segment.

Work & Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Proj. Incl. in Summary of Progress	Line Proj. Incl. in Area & Sub-subheading
S&R 3	Household and Industrial Consumer Attitudes and Sensory Discrimination Studies.			
S&R 3-1	Young people's use and appraisal of natural and competing fibers used in wearing apparel.	Washington, D. C.	Yes	1-A-1
S&R 3-2	Study of attitudes toward pilot food stamp operations. **	Washington, D. C.	No	
S&R 3-3	Fabric and fiber patterns of use and preference among automobile manufacturers. **	Washington, D. C.	No	
S&R 3-4	Study of the effect of selected characteristics of fresh citrus fruit on trade and consumer acceptance.	Washington, D. C.	No	
S&R 3-5	Consumer acceptance of sweetpotato flakes. **	Washington, D. C.	Yes	1-A-5
S&R 3-6	Consumer preferences, usages, and buying practices for noncitrus fruits.	Washington, D. C.	Yes	1-A-4
S&R 3-7	Study to determine consumer preferences and consumption patterns for various types of fluid milk.	Washington, D. C.	Yes	1-A-3
S&R 3-8	Consumer preferences, usages, and buying practices for poultry.	Washington, D. C.	Yes	1-A-2
S&R 3-9	Consumer interest in retail availability of ripe winter pears.	Washington, D. C.	No	
S&R 3-10	Women's attitudes toward cotton and other fibers used in wearing apparel. *	Washington, D. C.	Yes	1-A-1
S&R 3-11	Laboratory sensory evaluation of agricultural commodities. *	Washington, D. C.	Yes	1-B
S&R-0-0-1(DOD)	Homemakers' estimates of food on hand. **	Washington, D. C.	Yes	1-A-6
S&R 4	Improvement of Crop and Livestock Estimating Methods.			
S&R 4-1	Studies on the relationship of early-season plant observations made on sorghum and pasture grasses to final yield.	Ames, Iowa	Yes	2-A-7 2-A-8
S&R 4-3	Development of improved sample survey procedures for crop and livestock estimates in Western States.	Wash., D. C. & State offices in Ariz., Calif., Colo., Idaho, Mont., Nev., N. Mex., Oreg., Utah, Wash., & Wyo.	No	
S&R 4-5 (rev.)	Development of improved forecasts and estimates of wheat yields.	Wash., D. C. & State offices in Tex., Okla., Ill., Ind., Kans., Mich. Mo., Nebr., Ohio, Colo., Mont.,Idaho Wash., Oreg., S. Dak., N. Dak.,& Minn.	Yes	2-A-1
S&R 4-6	Development of improved forecasts and estimates of soybean yields in the selected States.	Wash., D. C. & State offices in Ark., Ill., Ind., Iowa, Kans., Mich. Minn., Miss., Mo., Nebr., & Ohio	Yes	2-A-3

* Initiated during reporting year.
** Discontinued during reporting year.

Line Project Check List -- Reporting Year July 1, 1963 to June 30, 1964

Work & Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Proj. Incl. in Summary of Progress	Line Proj. Incl. in Area & Sub-subheading
S&R 4-7	Development of an improved sampling and data collection procedure for estimating prices received and prices paid by farmers. **	Wash., D. C. & State office in Ohio	No	
S&R 4-8	Improvement of yield forecasts on sour cherries and apples through objective fruit counts and measurements.	Wash., D. C. & State office in Mich.	Yes	2-A-2
S&R 4-9	Development of improved forecasts for the yield of irrigated cotton.	Wash., D. C. & State offices of N. Mex., Ariz.,& Calif.	Yes	2-A-4
S&R 4-10	Probability mailing list from screened segments.	Wash., D. C.	Yes	2-B-3
S&R 4-11	Study of the farm operator as a supplier of agricultural statistics.	Raleigh, N. C.	No	
S&R 4-12	Study of lists of farm operators as sampling frames for collecting agricultural statistics.	Wash., D. C. & all continental States	Yes	2-B-2
S&R 4-13	Study of response and other non-sampling errors.	Wash., D. C. & Iowa & Ala.	Yes	2-B-1
S&R 4-14 (rev.)	Study of aerial photography as a supplementary survey technique in making crop and livestock estimates.	Wash., D. C. & all continental States	Yes	2-B-4
S&R 4-14	Development of improved sample survey procedures for crop and livestock estimates in northeastern States, Florida, Texas, Oklahoma, and other States. *	Wash., D. C. & State offices in New England, N. Y., N. J., Pa., Md., Del., W. Va., Fla., Tex., & Okla.	Yes	2-B-5

* Initiated during reporting year.
** Discontinued during reporting year.